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AN ALPINE VARIETY OF HOUSTONIA CAERULEA.

Arthur Stanley Pease and Albert Hanford Moore.

The striking white flowers of *Houstonia caerulea* in Tuckerman's Ravine have long attracted the attention of the numerous persons who travel through it every year, whether botanists or not, since these flowers form a very conspicuous part of the flora of the ravine.[1] The beautiful white color of the corolla, and brilliant yellow of the throat and upper part of the tube have for a long time led the authors to wonder if the plant in question might not be distinct from the lowland species. Several collections and a careful study at the Gray Herbarium have confirmed this suspicion.

The variety of Tuckerman's Ravine and the Alpine Garden may be readily distinguished by the color characters above referred to, together with the shape of the corolla tube. In the case of the alpine variety, the tube tapers gradually downward from the limb to the base without any striking differentiation into a broader and narrower portion. In the common variety, on the other hand, there is a long, straight, much more exserted tube, and then an abrupt, but usually narrow, funnel-like broadening just beneath the border. The following measurements, while not practicable for purposes of identification, are interesting evidences of the distinctness of the two phases. A careful series of measurements of the breadth of the corolla-tube at the widest portion, immediately below the limb, and the total length of the tube shows that, while individual measurements in both plants overlap, the averages are quite different. The average width in the mountain variety was found to be 2.04 mm. and the average length 3.41 mm. In the lowland plant these figures were respectively 1.80 and 4.58 mm.

[1] Cf. G. S. Miller in Proc. Bost. Soc. Nat. Hist. xxvi, 178 (Feb. 7, 1894) foot-note, "A very large, pale form, apparently distinct from the lowland plant."

The average ratio in the first instance was .59 and in the second .39. The measurements of the width range from 1.25–3 mm., those of the length from 3–4 mm. for the new variety, but from 1–2.75 mm. and 3–6 mm. respectively for the common variety.

Houstonia caerulea is described by Linnaeus as being blue. The ordinary lowland plant is not infrequently white, and has always a yellow throat, but this feature is not so striking, and it has the customary corolla-tube of the Bluet. It is presumably this phase which is referred to by Millspaugh in Flora of West Virginia, 375 (1892) as *Houstonia caerulea f. albiflora*, but it is listed without description.

The authors take great pleasure in dedicating the variety, whose characterization follows, to the late Edwin Faxon and to Charles Edward Faxon, now connected with the Arnold Arboretum, two brothers, whose collections of the flora of Mount Washington and vicinity have been among the most extensive and valuable in recent years.

Houstonia caerulea L. var. **Faxonorum** Pease et Moore var. nov. Flores candidi, faucibus flavissimis; corollae tubus sensim a limbo usque ad basim constrictus; tubi maxima latitudo 1.25–3 mm. (plerumque 2.04), longitudo 3–4 mm. (plerumque 3.41). Distributio in alpinis Montium Alborum.

Houstonia serpyllifolia Grah. (not Michx.) in Bot. Mag. lv, pl. 2822 (1828). Here the above variety is clearly figured. For an illustration of the type see Bot. Mag. xi, pl. 370 (1797).

Type specimen: New Hampshire, Coös County, Headwall of Tuckerman's Ravine, Sargent's Purchase, July 29, 1907 (*A. H. Moore*, no. 4047 in Herb. Moore. Co-types in Herbb. Gray, Pease, and Bartlett).

Other specimens examined: New Hampshire, Coös County, Headwall of Tuckerman's Ravine, Sargent's Purchase, August 14, 1902 (*A. H. Moore*, no. 291) and August 28, 1907 (*A. S. Pease*, no. 10732); Alpine Garden, Sargent's Purchase, August 19, 1907 (*A. S. Pease*, no. 10558); Mt. Washington, within 2–300 ft. of summit, Sargent's Purchase, August 6, 1897 (*W. Deane*).

Cambridge, Massachusetts.

MENDEL'S LAW OF DOMINANCE IN THE HYBRIDS OF VIOLA.

E. Brainerd.

In a recent paper[1] I gave some account of certain experimental cultures of the offspring of violet hybrids. It was shown that these seedlings diverge in a striking manner from the mother plant and from each other, in accordance with the laws of heredity that Mendel found to control the progeny of a hybrid. During the past summer I have been able to trace the operation of these laws in the characters of the petaliferous flowers of these seedlings, and in several cases have raised a second generation of seedlings.

In these experiments it has clearly come to light, that in some particulars at least, Mendel's Law of Dominance finds illustration among violet hybrids. The special instance of this that I wish to present in detail, relates to the inheritance of color of capsules and of seeds in *V. hirsutula* × *papilionacea*, briefly discussed in Rhodora, ix. 93, June 1907.

The putative parents of this hybrid differ from each other as shown in the following table:—

		V. hirsutula	V. papilionacea
Leaves	habit	nearly prostrate	erect
	width	2–4 cm.	5–10 cm.
	upper surface	hirsutulous	glabrous
	petioles	glabrous	somewhat hairy
Flowers	color	reddish purple	deep violet
	spurred petal	villous	glabrous
Capsules	length	6–8 mm.	10–15 mm.
	color	purple	green
	number of seeds	20–30	50–70
Seeds	length	1.6 mm.	2 mm.
	color	buff	dark brown

The offspring of the hybrid present, in the most varied manner, a redistribution of most of these points of difference. Segregation in leaf characters was especially well marked. The differences in size of capsule and in number of seeds were obscured by the impairment

[1] Read before sections F & G of the A. A. A. S., Dec. 27, 1906, and printed in Science June 14, 1907.

of fertility, which though not as great as in many violet hybrids, was yet in some plants sufficient to make the evidence ambiguous. Attention will be here restricted to the two points of color difference, in which Mendelian dominance is plainly manifest.

In the hybrid from the wild the capsules are a reddish purple, like those of *V. hirsutula*. The tendency to produce the green capsules of the other parent is however present, for it appears in some of the offspring; but in the mother hybrid it is overpowered by the conflicting tendency to produce purple capsules. In Mendel's language, the purple color is 'dominant,' the green color 'recessive.' In like manner it appears that the brown seed-color of *V. papilionacea* is dominant over the buff seed-color of *V. hirsutula*. Mendel represented dominant characters by capital letters, recessive characters by the corresponding small letters. Following his practice, we may let **A** stand for the purple capsule-color, and **a** for the green capsule-color; **B** for the brown seed-color, and **b** for the buff seed-color. One parent, *V. hirsutula*, will then be marked as **A.b**; the other, *V. papilionacea*, as **a.B**; and the hybrid resulting from their sexual union as **Aa.Bb**.

The plants from the wild are presumed to have been the immediate result of the crossing of the two species,— what are technically known as F_1's. It may well be that they are removed one or more generations from the original cross; but this is not of especial importance in the present experiment, as it will be seen that these particular plants, so far at least as respects the two color qualities under investigation, are hybrids of exactly the same status as 'first crosses.'

From the close-fertilized seeds of these plants I raised in 1906 11 offspring, F_2's; and in 1907, 10 offspring; in all, 21. Among these all the four Mendelian forms were found to occur, in number and character as follows:

10	plants	had	purple	capsules	and	brown	seeds,	apparently	**A.B.**
3	"	"	"	"	"	buff	"	"	**A.b.**
5	"	"	green	"	"	brown	"	"	**a.B.**
3	"	"	"	"	"	buff	"		**a.b.**

A close approximation to the theoretically required ratio of '9:3:3:1' is to be expected only when there are several hundred individuals; but even in the small number here shown there is a decided plurality of **A.B's.**

The different forms of these capsules and their seeds are shown in

fig. 1, in which the purple capsules and brown seeds are shaded, and the green capsules and buff seeds are left white.

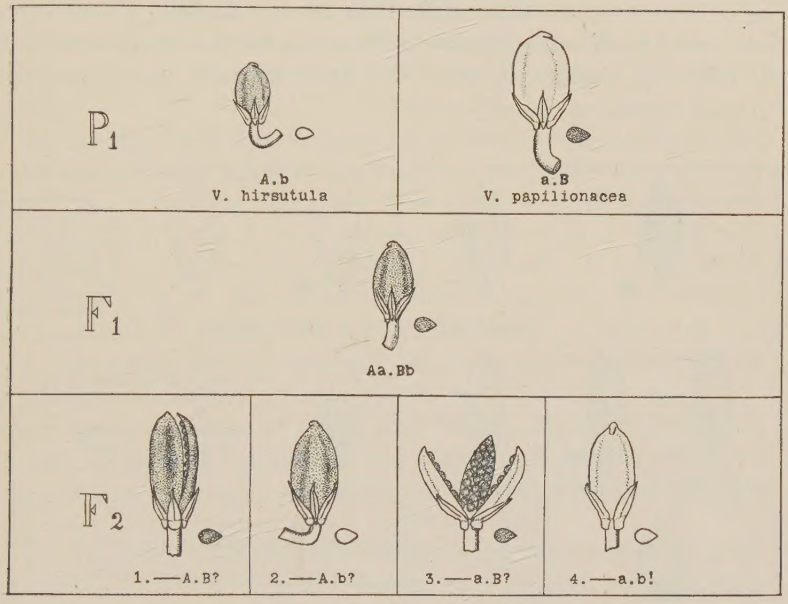

Fig. 1.—Capsules and Seeds of Viola hirsutula × papilionacea, and of its Parents and Offspring.

In 1907 offspring were obtained of six different plants of the eleven raised in 1906. In order to interpret the results, the reader who is not familiar with the laws of Mendel, will be helped by a brief preliminary discussion of the real nature of the four forms of F_2 that appear as the product of the first sowing. As a matter of fact there are five other forms, that masquerade under one or another of the first three forms shown above. We are not sure, among these, in a plant with purple capsules, but that there is also a latent tendency to produce green capsules, kept in check in this individual plant by the dominance of the purple tendency, but able to assert itself in some of the offspring That is, we do not know whether the **A** is pure **A** or **Aa**. Similarly we are not sure in a plant that bears brown seeds but that there is also a latent tendency to bear buff seeds, repressed in this individual plant by the stronger tendency to bear brown seeds, but able to

assert itself in some of the offspring; **B** may be simply **B** or **Bb**; it may be pure or hybrid. Accordingly, under form 3 above we may have either **a.B.** or **a.Bb**; under form 2 either **A.b** or **Aa.b**; and under form 1 either **A.B**, **A.Bb**, **Aa.B**, or **Aa.Bb**. The fourth form, **a.b**, is without ambiguity. These possibilities are pictured in the following diagram, in which the latent hybridity is represented by small crosses on capsule or seed.

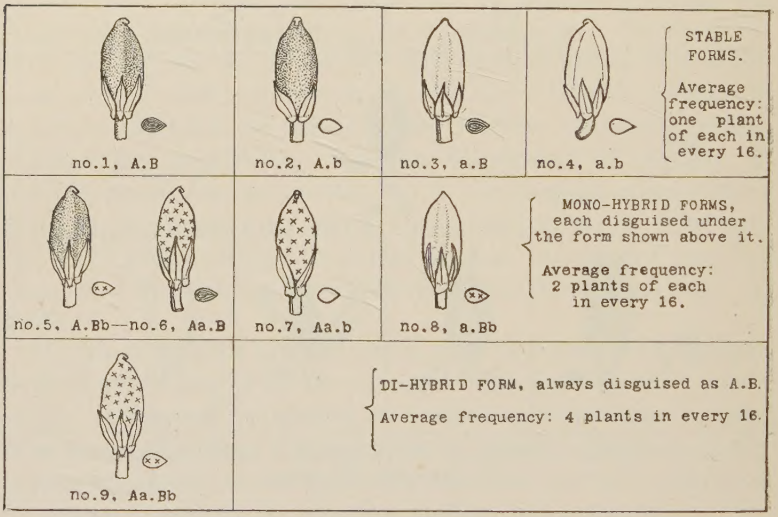

Fig. 2.—Color Forms in Offspring of V. hirsutula × papilionacea.

It will be seen at once that to determine the real nature of any one of the first three of the F_2's in fig. 1, we need to grow its seeds. The apparent forms of the six plants whose seeds were sown, and of their offspring, are given in the following table:

Form of F_2	A.B	A.B	A.B	A.b	a.B	a.b
Seed-number	340	337	339	334	333	338
Forms of F_3 obtained, and the number of plants of each form.	A.B–4 a.B–2	A.B–4 A. b–1 a.B–3	a.b–1	A.b–4	a.B–6	a.b–5

The plants raised from these six sowings were so few (largely from lack of time to transplant) that the numerical results are unimportant;

but in no instance is there a failure to comply with the laws of Mendel. The following points should be noted:—

1. In the sowing numbered 338 all five offspring are like the parent **a.b**,— have green capsules and buff seeds; a recessive character (in this case a double recessive) must always breed true. Here we have a new and stable form, which as a whole is unlike either of the original species.

2. We may infer that the plant from which seeds numbered 333 were obtained was probably pure, that is, was really **a.B** and not **a.Bb**; had it been the latter, one or more of the six offspring would probably have had buff seeds, or been **a.b**. Perhaps as regards capsule-color 334 was also pure,— **A.b** and not **Aa.b**. If so, we should have here in color characters complete reversions to the respective grandparents, *V. papilionacea* and *V. hirsutula*.

3. In sowing 339, though only one seed germinated, it tells the whole story regarding the form of the parent,— it must have been the di-hybrid **Aa.Bb**, and thus exactly like the immediate parent F_1. A plant with purple capsules and brown seeds produces one with green capsules and buff seeds; a feat to be expected of a di-hybrid, though only once in every sixteen plants that it reproduces.

4. The proof is equally clear that in sowing 337 we have the seeds of another di-hybrid; it throws both sorts of capsules and both sorts of seeds.

5. In sowing 340 the result is somewhat ambiguous;— the mother may be either **Aa.Bb** or **Aa.B**; it could not be **A.Bb** or **A.B**.

6. Though three apparent **A.B**'s were sown, none proved to be pure or stable like no. 1 of fig. 2. But in the offspring of a di-hybrid the chances are that only one in nine, that have the form **A.B**, will turn out to be that in reality.

I much regret that the experiment was not conducted on a larger scale; but it should be borne in mind that the object was not to verify the Laws of Mendel,— that is now quite unnecessary; but, conversely to prove that as these seedlings in their metamorphoses obey the laws of Mendel, their parent was of hybrid origin. Disappointed in my expectation that the artificial production of violet hybrids would be attempted at a certain 'biological laboratory,' it occurred to me over two years ago that equally valuable results might be gotten by observing the behavior of the offspring of the supposed

hybrids. As pointed out by Dr. McDougal,[1] the test of a suspected natural hybrid may often be better made by the Method of Analysis than by the Method of Synthesis. In the genus Viola the analytic method has proved unexpectedly successful. Over thirty putative hybrids have produced offspring that segregate in accordance with Mendelian principles.

An objection recently made to the occurrence of hybrids in Viola is based on the supposed fact "that 99 out of 100 seeds of these plants"[2] are from self-fertilized flowers. This led me last June to examine with reference to this matter plants of some eighteen species of our stemless violets, and revealed the fact that all but two of these plants produced seed freely from the petaliferous flowers; in some instances over 300 such seeds were produced by a single plant.[3] The structure of the flower, in style stamens and petals, shows a most ingenious arrangement to prevent self-pollination; and it is now evident that the ovules are readily fertilized by the pollen of an allied species. The coexistence of this habit with the opposite habit of producing in summer self-fertilized flowers is apparently the cause of the multiplicity of forms in this group of plants. Hybridism gives rise to numerous intergradient types; cleistogamy preserves them from further intermixture more skilfully than the artificial hybridizer with his paper bags, and permits the laws of Mendel to work out their natural results, giving rise often to new varieties and races. The behavior of violet hybrids and their offspring under cultivation presents many striking illustrations of this procedure, and awakens the hope that with this clew to guide us we may solve some of the long-standing perplexities of the genus.

Middlebury, Vermont.

[1] Hybridization of Wild Plants, Bot. Gazette xliii. 11–44, Jan. 1907.

[2] Prof. E. L. Greene, Leaflets i. 214.

[3] Five plants of *V. nephrophylla* furnished at one time from the capsules of petaliferous flowers 1227 ripe seeds.

PRIMULA FARINOSA, VAR. MACROPODA ON THE MAINE COAST.

Joseph A. Cushman.

While I was collecting on the coast of Maine about Machias Bay in early August my attention was called to the occurrence of a peculiar plant said to be found at the base of the lighthouse on Libby Islands. It was thought to have been brought there by birds which frequently fly against the lighthouse and are killed. To see what this plant might be I visited the island with Mr. S. N. F. Sanford and found the plant in very considerable numbers. It proved to be *Primula farinosa* L., var. *macropoda* Fernald. The only places where it occurred were at the base of the lighthouse and the ground about the oil-house nearby. At the time of collecting, the plants were in excellent fruit and certainly seemed thoroughly established. They were growing in loose sandy loam well grassed over. From its appearance it was soil which had been added there by grading and was not in its original position.

From the occurrence of the plants it seemed in every way probable that the seeds were brought, as was first told us, by birds coming from farther north. As is well known, many birds are killed by flying against lighthouses at the various exposed points along the coast. The very limited occurrence about the lighthouse seems to be explained only in this way.

After visiting the island we studied the chart of the region and decided to make a trip to Moose Peak Light on Mistake Island. This is the outer exposed point of the northeastern chain of islands extending out from Jonesport. This was in the direction which birds would probably take in migration. If the theory of the source of the other station was true it seemed as though the plant should be found there also. A day or two later we visited Mistake Island and were much pleased to find the plant there though the individuals were much fewer in number. It was growing near the light on moist granitic cliffs but in considerable soil. On the same day we also landed at Black Head on the outer part of Head Harbor Island. On the summit were found scattered specimens of the same plant. These were growing in wet grassy spots among the rocks and appeared more likely to be indigenous than in either of the other places visited. It was planned to visit Nash Island still farther to the southwest but time and

weather conditions prevented our doing so. In all, three stations were discovered for this plant. These are of especial interest as the only other New England station was Mt. Kineo, Moosehead Lake, Maine. Although I collected on Mt. Kineo about three weeks later and made a point of looking for this plant no trace of it was found but I have since been informed by Dr. Kennedy that his specimens were found at the eastern end of the cliffs at a spot I did not reach.

From our observations it would seem likely that the plant may be found about the lighthouses still farther to the southwest along the outer points of the Maine Coast.

Boston Society of Natural History.

NOTEWORTHY PLANTS COLLECTED AT ROQUE BLUFFS, MAINE, IN 1907.

C. H. Knowlton.

During the past summer I spent several days collecting in Washington County, Maine, mostly in the township of Roque Bluffs. This lies on the coast, 16 miles from Cutler, and 22 from Mt. Desert. The summer climate there is cool and very wet, because the Greenland current washes the shore and causes frequent fogs.

The coast is lined with cliffs of volcanic rock, broken by occasional sea-caves, estuaries and beaches. In many places heavy spruce woods come down to the edge of the sea-cliffs, with such typical plants of the northern mountain woods as *Solidago macrophylla*, Pursh, and *Aspidium spinulosum* (O. F. Mueller) Sw. var. *dilatatum* (Hoffm.) Hook. forma *anadenium* B. L. Robinson.

Back from the cliffs are numerous and extensive peat-bogs, covered with *Picea nigra* Link., *Eriophorum callitrix* Chamisso, *Smilacina trifolia* Desf., *Empetrum nigrum* L., *Rubus Chamaemorus* L., *Vaccinium Oxycoccus* L., and more common bog plants.

I have not fully explored the region, and the estuaries in particular will probably reward further search. The following species already collected, however, seem worthy of mention.

Elymus mollis Trin. is a common beach grass, growing in the same sandy soil as *Ammophila arundinacea*, Hostk.,— but not so abundant.

Iris setosa Pall. Very common within reach of spray from the sea, but never competing with *I. versicolor* L., inland.

Comandra livida Richards. Very common on Johnson's Beach bog, with *Rubus Chamaemorus* L., but there were no blossoms or fruit visible (July 6). This is the first New England station at sea level, as the other reports are from five granitic mountain tops (Mansfield, Clinton, Saddleback, Abraham and Katahdin). It occurs at sea level in New Brunswick and northward.

Suaeda Richii Fernald. Common along the edges of the salt marshes.

Montia fontana L. Moist open woods, Roque Island.

Empetrum nigrum, L. var. *andinum* DC. Common on the top of the sea-cliffs, in residual gravel, the branches frequently hanging down. The typical form of the species seems to grow only in peat-moss. (Rhodora, IV, 196.)

Boston, Mass.

Notothylas orbicularis in Massachusetts.— On October 9, 1907, while collecting with a class in Cryptogamic Botany, on the Wellesley College campus, I found a number of plants of *Notothylas orbicularis* (Schwein.) Sulliv. The *Notothylas* was growing on wet sandy soil, in company with *Anthoceros*, and equally abundant. Dr. A. W. Evans has confirmed my identification of the material.

As there seem to be few specimens in herbaria, it may be worth while to record what is known of Massachusetts stations for the plant. Dr. Evans states that the only Massachusetts specimens, of which he knows, were collected at Cambridge, and are in the Underwood Herbarium. There is but one specimen in the Cryptogamic Herbarium of Harvard University, having been collected by Dr. Farlow at Newton, in a locality where now probably extinct. In addition to these specimens, Dr. Evans has found *Notothylas* at Falmouth, Dr. Farlow at Cambridge, and Dr. Thaxter at Waverley. In none of these cases, however, was material preserved. To these should now be added the Wellesley locality. Specimens of this collection have been deposited in the Herbarium of Wellesley College, in the Herbarium of Dr. A. W. Evans, at Yale University, and in the Cryptogamic Herbarium of Harvard University.

The records from the localities named above suggest that *Notothylas* is probably well distributed through Massachusetts and perhaps

further north, but has been overlooked. It, therefore, seemed well to call the attention of New England botanists to the plant, that they may watch for it in future collecting, and give us more exact knowledge of its distribution.— Lincoln Ware Riddle, Wellesley College, Wellesley, Massachusetts.

Rediscovery of Podostemon ceratophyllus in Vermont.— While crossing the West River about one fourth mile below the railroad station in Jamaica, Vermont, one day the past summer, my attention was attracted by a curious sea-weed like plant which adhered closely to the stones of the river bed, and which seemed to be abundant over a considerable area. It being the dry season (August) some stones bearing the plant were out of water. Upon being submitted to the Harvard Botanical Department the plant proved to be the river weed *Podostemon ceratophyllus* Michx. This plant has before been reported from Vermont by Frost but has been placed upon the doubtful list in the Flora of Vermont. The station is only accessible at low water but no doubt the plant may be found at other places in the bed of West River.— Frank Dobbin, Shushan, New York.

A new Variety of Scirpus Olneyi.— The genus *Scirpus* is somewhat remarkable for the number of its varieties with elongated spikelets, so it was not surprising when, in Milford, Conn., Sept. 28, 1907, during an excursion of the Connecticut Botanical Society, the writer found an additional variety of this class, which may be described as follows:—

Scirpus Olneyi Gray, var. **contortus**, n. var. Some or all of the spikelets twisted or bent, linear, elongated (1–2, rarely 2.4 cm. in length); involucral leaf prolonged (3–7 cm.) and, like the stem, not so stout as in the species. Brackish marsh on the coast, Milford, Conn., *E. H. Eames*, no. 5847. Type, in herb. Eames: co-type in herb. Gray.

Conspicuously different from the species in the foregoing characters; and from allied species, among other features, in the remarkable triquetrous-winged stem.— E. H. Eames, Bridgeport, Connecticut.

Vol. 9, no. 106, incl uding pages 197–208 and plate 76, was issued 26 October, 1907.